DOCUMENT RESUME

ED 107 208 IR 001 931

AUTHOR MacKinnon, R. J.; Schuegraf, Ernst J.
TITLE A Minicomputer as Front End Processor for an Automated Library System.
PUB DATE May 75
NOTE 8p.; Paper presented at the Canadian Conference on Information Science (3rd, Quebec City, Quebec, May 1975)

EDRS PRICE MF-$0.76 HC-$1.58 PLUS POSTAGE
DESCRIPTORS Computer Programs; *Computers; Cost Effectiveness; Data Bases; Libraries; *Library Automation; Library Cooperation; *Library Networks; Library Technical Processes; *On Line Systems; Shared Services
IDENTIFIERS *Minicomputers

ABSTRACT

Because the cost of computers has decreased significantly in the last few years and their capabilities have increased significantly, a minicomputer is proposed as the front end processor for an automated library system of a medium sized library. The local library processor is to be connected to a larger computer which hosts the data base and executes tasks for which the computing power of the minicomputer is insufficient. The distribution of system modules between the two processors is investigated, and the library functions which can be locally processed are identified. The economic advantages offered by such a system are described, and the implications for a network of library processors are considered. References are included. (Author/KKC)

ED107208

A MINICOMPUTER AS FRONT END PROCESSOR FOR AN AUTOMATED LIBRARY SYSTEM (UN MINI-ORDINATEUR COMME APPAREIL DE CONSOMMATION POUR UN SYSTÈME BIBLIOTHÈQUE AUTOMATISÉ)

R.J. MacKinnon and E.J. Schuegraf
Department of Mathematics
St. Francis Xavier University, Antigonish, N.S.

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

ABSTRACT

A minicomputer is proposed as the front end processor for an automated library system of a medium sized library. The local library processor is to be connected to a larger computer which hosts the data base and executes tasks for which the computing power of the minicomputer is insufficient. The distribution of system modules between the two processors is investigated and library functions which can be locally processed are identified. The economic advantages offered by such a system are described and the implications for a network of library processors are considered. (On propose l'emploi d'un mini-ordinateur comme appareil de consommation ("Front End Processor") dans un système bibliothèque automatisé à servir une bibliothèque de grandeur moyenne. L'appareil dans la bibliothèque sera joint à un plus grand ordinateur qui contiendra la banque d'information et exécutera les tâches impossibles pour le mini-ordinateur. On étudie la distribution des modules entre les deux ordinateurs et on identifie les fonctions qui peuvent être opérées sur lieu. On décrit les avantages économiques du système et l'on considère les changements nécessaires pour établir un réseau d'ordinateurs dans une bibliothèque.)

INTRODUCTION

Until recently library automation based on modern computer technology has been an almost unattainable goal for many small or medium sized libraries. Many reasons, human as well as technological account for the difficulties in achieving this goal. These reasons included among others the high cost of a dedicated library processor, the lack of technical expertise and the expense and manpower needed for the development of such a complex software system.

Fortunately the picture has improved considerably in the last few years due to various developments. The cost of computers has dropped significantly, especially for minicomputers and microprocessors, but at the same time their capabilities have increased tremendously. The multi-programming and communication capability of some mini-computers is well beyond the ability of some "older," medium sized main-frame computers.

IR 001 931

MINICOMPUTER FOR AN AUTOMATED LIBRARY

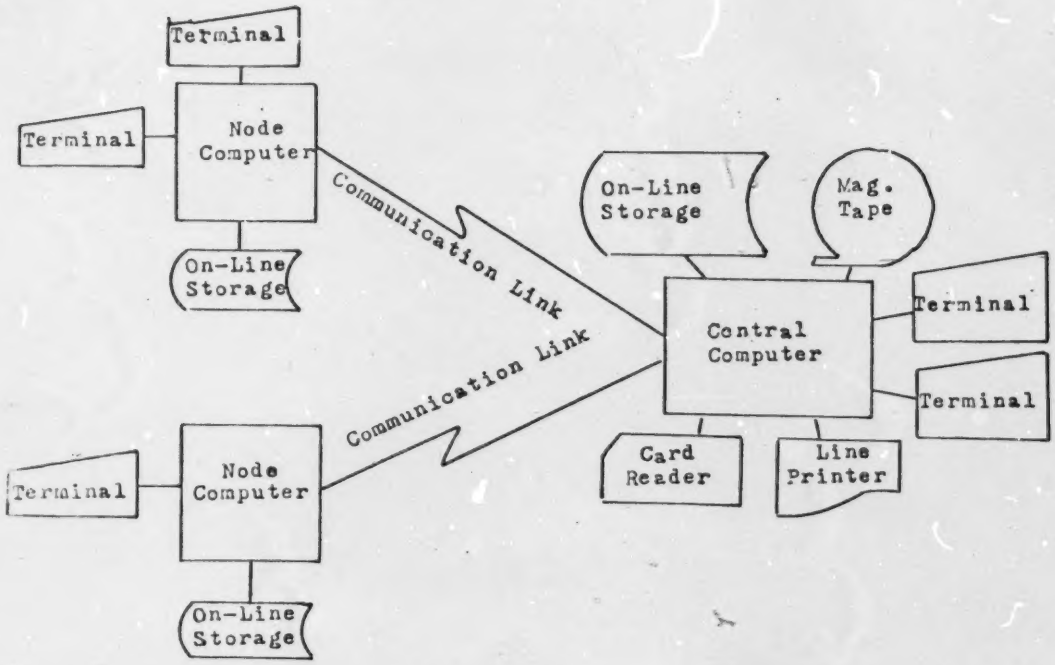
Considerable progress has been made in the development of computer networks and inter-processor communication. Technical expertise has also increased since some of the larger libraries have developed automated systems and reported on their experience.

In some cases the cost of system development has forced libraries to cooperate and this cooperation has spawned small networks. The cooperation between libraries and the concept of a library network was aided by the evolution of a national standard for machine bibliographic records, the Canadian MARC (Canadian MARC office 1973). The Ontario universities' Library Co-operative Systems project (OUCLS) is the Canadian example for this development. This system as well as that of the OCLC offer on-line cataloguing via terminals at the users site. These are connected to a central computer which hosts and manages the catalog data base and controls all the peripherals needed for production of reports, catalog cards and other materials. This arrangements may be considered as the most economic, when we take into account the high cost of peripherals for on-line storage, hard copy output and manpower for system support.

However, these systems do not offer at the present other library functions such as circulation control, automatic ordering or budget management. These functions as well as participation in a cooperative network could be provided by a "Load Distributed Library System" (LDLS).

SYSTEM STRUCTURE

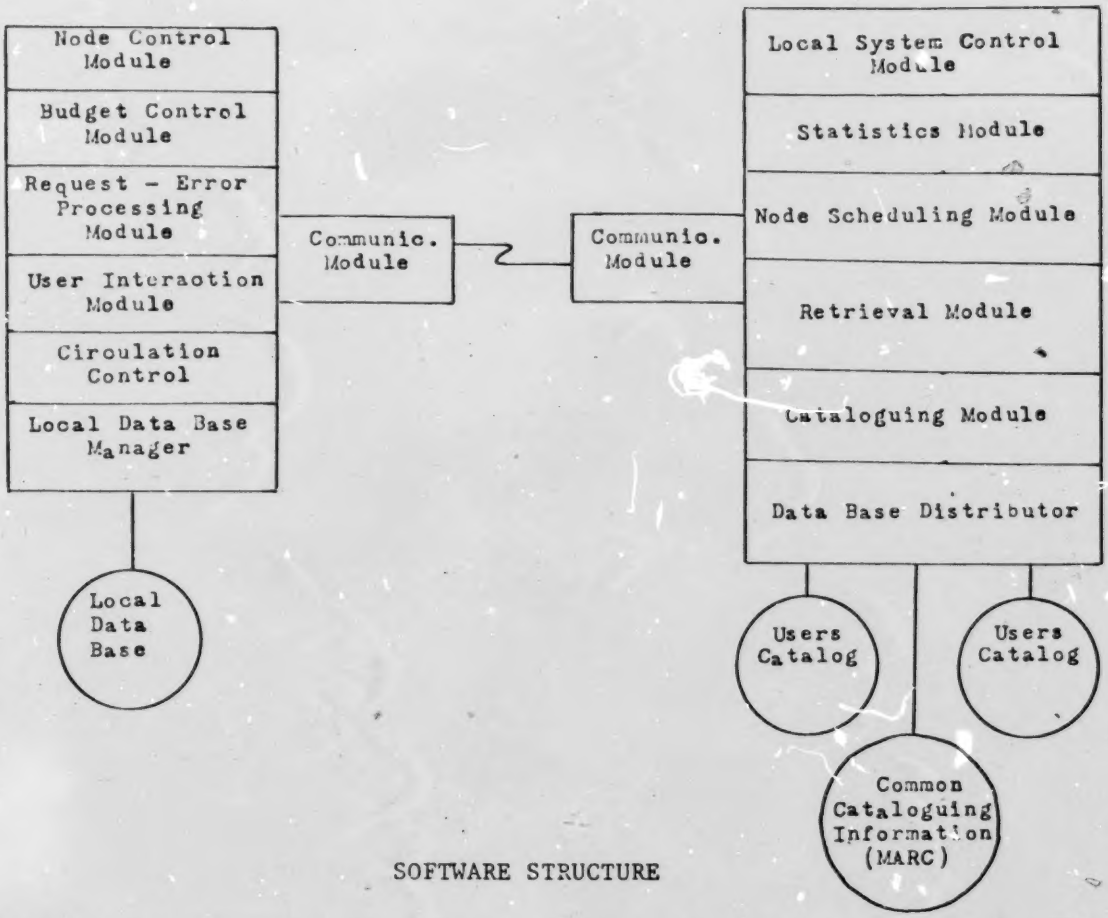
Hardware: The proposed structure of the hardware resembles existing systems in its star-like arrangement. Each participating library should be equipped with a minicomputer, a few terminals, some small on-line storage facility and a slow speed output device. The minicomputer is to be connected to a computer at a central location which is to have all the features the local library processor is lacking. Large amounts of on-line storage, magnetic tape units as well as high speed printers are to be provided by the center. It may be considered as a shared Back-End-Processor for data base management (Canaday et al. 1974), communicating with the Front-End-Processor in each library. The structure of the system hardware is shown in Figure 1.



HARDWARE STRUCTURE

Since the outer nodes in this system have more computing power than in some present library networks, they can share some of the load usually carried by the central processor. In addition to taking on some of this load, the minicomputers at the nodes can provide some of the local library functions such as circulation control. With this distribution of responsibilities it is conceivable that a large minicomputer would be sufficient as the center of the network.

Software: The operation of such a system requires a clear division of system functions and a separation of software modules between nodes and the center of the network. The distribution of functions between the two systems components is shown in Figure 2.



SOFTWARE STRUCTURE

The responsibility of the node computer is to execute all the functions which are only of interest to the individual library. Among these tasks are user interaction,user education, budget management and circulation control. For the latter purposes a small data base managed exclusively by the mini should be sufficient for most medium sized libraries. The major task of the node is the control of access and communication with the main computer. Each access request is to be checked for errors, verified for proper access authority and transformed into a standard format before transmission to the main center. Messages and output received from the center must be decoded and put into the proper local format and directed to the proper terminal. This is the regular function of a Front-End Processor. The communication module is the software section assigned to the control of traffic between node and center. Each of the nodes must possess one of these modules which has to produce "standard" output and must be able to accept "standard" input.

The communication module of the central unit receives and sends these standard messages. All messages are interpreted and translated into system commands and passed to the system control module. A command may initiate a search in one of the nodes catalog data base, or request information about a monograph to be catalogued. It may pass an inter-library loan request to a different node or may ask for the production of catalog cards, reports or other hard copy output.

The system control modules responsibility is the management of the node interaction, the allocation of resources and internal scheduling. It queues requests for accesses of individual or shared data bases, decides on execution priority and the use of other modules.

ADVANTAGES AND DISADVANTAGES

Technical: It has already been shown (Grosch 1973) that minicomputers have the capacity to serve as the processor for an automated library system. The special capabilities of minicomputers can be utilized to achieve better performance. For instance microprogramming may be used to implement special instructions to manipulate bibliographic records, allow easy text searching and others. This firmware implementation of special instructions could yield a processor more suited to its special task (Thompson 1974). This applies to the nodes as well as to the main center.

One of the advantages of a LDLS is the relative insensitivity to breakdown of one of the system's components. If one of the nodes breaks down the rest of the system is unaffected. Should the main center break down the capabilities of the nodes are sufficient to work as stand alone units. Requests to the center must be queued up locally and certain functions are held up until the main unit resumes operation.

However, the major advantage is offered by the software. Since there is only one module for managing the data bases, each library shares its use and it has to be developed only once. It is conceivable that a manufacturer provided data base management system can serve for this purpose (Duchesne 1974). The modular construction of the main unit's software allows for a step by step development and can be tailored to the needs of the participants.

The development of the software for the nodes can also be shared, since a skeleton system can be developed for all nodes. Patches can be added to this skeleton to accommodate local variations in the operation of a library. It is imperative that this skeleton be developed in a standard high level language to achieve the highest degree of portability possible (Poole and Waite 1973).

One of the possible disadvantages of the proposed system is a delay in response time between requests and answers. This delay includes time lost through coding, transmission and decoding of requests, but these

factors are negligible in comparison to delay due to queueing at the central computer. However, this delay may be minimized by proper choice of the central processor, so that even during hours of peak demand the response time is still tolerable. A tradeoff exists between processor cost and system response time.

Another disadvantage may be unused capacity because of unbalanced system resources. This would be a small problem since there is a great variety of computers available and the needs can be well matched with a system by proper selection. The flexibility in the distribution of the software modules can also be utilized to achieve a more evenly distributed load.

ECONOMIC

The main reason for proposing a LDLS are the economic benefits which can accrue. A few of these possible benefits will be mentioned, but the list is not intended to be exhaustive.

The main advantage of the proposed approach is what Canaday et al. (1974) call "Economy through Specialization." The capacity of the node computers as well as that of the main unit can be matched with the needs, so that no computing power is wasted. Furthermore the specialized tasks of the processors allow the utilization of the hardware more efficiently to achieve better throughput. Special options usually found in general purpose computers (like floating point hardware) need not be purchased; thus reducing machine cost.

It must be mentioned that the initial cost of the node-computers is not as high as one would suspect. Networks which use message switching for communication between terminals and center do require an intelligent Front End Processor. It does not cost much more to upgrade an intelligent controller to a computer capable of simultaneously performing the tasks of a node and that of a Front-End Processor.

The inherent flexibility of a distributed network also offers benefits especially with regard to changes in the network. Upgrading of one node-computer does not add to the cost of the other nodes or even disturb system operation. A change in the central unit does not require changes in the nodes unless message standards are changed. Addition of "fancy" patches to the software skeleton of a node are the sole responsibility of the requesting library and thus do not impose costs on the other participants.

The economic benefits of software, data base and resource sharing offered by a network are also exhibited in the system. If more than one network of library processors exists with a similar structure then other advantages can be realized. A node computer may communicate and exchange information with a center different from its own. This exchange can be

achieved by selecting the proper communication module for the center to be accessed.

This concept of flexible access is of considerable practical importance in a network of library computers. Regional centers may store and manage the data bases for all the nodes in its area. They should carry most of the regular load and the everyday processing. However, the nodes are free to access other regional centers if it is economical and the need dictates this communication with a "foreign" center.

REFERENCES

CANADAY, R.H., HARRISON, R.D., IVIE, E.L., RYDER, J.L., L.A. WEHR, 1974 A back-end computer for data base management. Comm. ACM, vol. 17, 575-582.

DUCHESNE, R.M. 1974 Canadian national bibliographic data base study, National Library, Ottawa.

Canadian MARC Office 1973 "Canadian MARC." Information Canada, Ottawa.

GROSCH, A.N., 1973 Minicomputer versus maxicomputer for on-line library systems in medical libraries. Proc. ASIS, vol. 8, 77-78.

POOLE, P.C., WAITE, W.M. 1973 Portability and adaptibility in "Advanced course in software engineering," F.L. Bauer, Edtr., Springer Verlag, New York, 1973

THOMPSON, J.L. 1974 "Hardware, software and firmware for symbol manipulation," Paper presented at the Workshop on Computer Architecture for Non-numeric Processing, Dallas, Texas, 14-15 Oct.